REMARKS

Information Disclosure Statement

An Information Disclosure Statement is being filed concurrently with this Amendment. The IDS cites a related application, U.S. application serial no. 09/274,128, filed March 22, 1999. The related application is a division of the present application, which has been allowed but has not issued. Also included in the IDS are the allowed claims from the related application.

Amendments to Drawing

Permission is requested to substitute new formal drawings having improved line quality for the originally submitted drawings. A copy of the new formal drawings is attached to this Amendment. However, submission of the new formal drawings to the "Official Draftsperson" will be delayed pending an indication of allowable subject matter.

Rejections Under 35 USC §103

Claims 1-20 have been rejected under 35 USC 103(a) as being unpatentable over DiLeo et al. in view of either Nishino et al. (US Patent No. 5,739,205) or Litke (US Patent No. 4,533,422).

Claims 1-20 have been rejected under 35 USC 103(a) as being unpatentable over DiLeo et al. in view of Mikuni et al. (US Patent No. 5,175,337) and further in view of either Nishino et al. (US Patent No. 5,739,205) or Litke (US Patent No. 4,533,422).

Claims 1-20 have been rejected under 35 USC 103(a) as being unpatentable over DiLeo et al. in view of either Nishino et al. (US Patent No. 5,739,205) or Litke (US Patent No. 4,533,422) and further in view of O'Sullivan et al. (US Patent No. 3,832,334).

Claims 21-42 and 40-44 have been rejected under 35 USC 103(a) as being unpatentable over DiLeo et al. (US Patent No.

4,209,358) in view of Burnett et al. (US Patent No. 2,628,178) and Gruber et al (US Patent No. 3,987,019).

The rejections under 35 USC §103(a) are traversed for the reasons to follow.

Double Patenting Rejections

Claims 1-22 and 40-44 have been provisionally rejected under the judicially created doctrine of double patenting over claims 22-27, 29-39,41-45, 53-62 and 64 of copending application serial nos. 09/065,944 and 09/651,217.

These rejections are traversed, as the priority date of the present application (August 22, 1997) precedes the priority date (April 24, 1998) of both of the above cited applications. Accordingly, the cited applications cannot be considered prior art under 35 USC §103, or under the doctrine of judicially created double patenting.

Summary of the Invention

The pending claims are directed to a "method for packaging a semiconductor die to form a semiconductor package". As recited in claim 1, the method includes the steps of "providing a leadframe", and "providing a cyanoacrylate adhesive material formulated to cure in contact with the die in less than about 60 seconds in a temperature of about 20°C to 30°C and an ambient atmosphere".

Claim 1 also recites the steps of "providing a filler in the adhesive material selected to tailor a characteristic of the adhesive material in the package", "applying the adhesive material to the leadframe or the die", "placing the die on the leadframe with the adhesive material in contact with the die", and "curing the adhesive material in the temperature and the ambient atmosphere in less than about 60 seconds to bond the die to the leadframe".

Independent claim 6 is similar to claim 1 but states the leadframe comprises "a plurality of lead fingers". This type of leadframe (14A-Figure 5) is sometimes referred to as lead-

on-chip leadframe. Claim 6 also recites the steps of "placing the die on the lead fingers with the adhesive material compressed between the die and the lead fingers", and "wire bonding the die to the lead fingers".

Independent claim 12 is similar to claim 6 but states that the adhesive material comprises "an electrically insulating filler configured to increase a dielectric strength of the adhesive material".

Independent claim 15 is similar to claim 1 but recites a formula for the adhesive material, and also recites a "wire bonding" step.

Independent claim 21 is similar to claim 1 but recites that the adhesive material comprises an "anaerobic acrylic". Claim 21 also recites specific compounds for the filler, and a "wire bonding" step.

Independent claim 42 is similar to claim 6 but states that the adhesive material comprises either a "cyanoacrylate adhesive" or an "anaerobic acrylic".

Argument

The 35 USC §103 rejections were originally presented with the Office Action dated May 23, 2000 (Paper No. 10). The same 35 USC §103 rejections were restated in the Office Action dated December 14, 2000 (Paper No. 14), and in the Office Action dated June 18, 2001 (Paper No. 16). In response to the 35 USC §103 rejections, Applicants filed Amendments on September 22, 2000, March 14, 2001 and September 18, 2001.

Although the present Amendment amends the claims, the amended claims are substantially similar to those of the last Amendment (September 18, 2001). However, at this time Applicants would like to summarize and supplement the previous arguments of record. Applicants also request reconsideration of these arguments, and withdrawal of the 35 USC §103 rejections.

With respect to the 35 USC §103 rejections, Applicants have argued that the cited references do not teach all of the features of the presently claimed method. These features with other recited features, define a semiconductor packaging method that "taken as a whole" is unobvious over the prior art. In addition, Applicants have argued that there is no incentive in the cited references (or the prior art in general) for the cited combination of references.

A first feature not taught or suggested by the references is that the present claims are directed to a "method for packaging a semiconductor die to form a semiconductor package". As such, the claims state the steps of "providing a lead frame". Some of the claims specify that the lead frame has "lead fingers", and is "configured for wire bonding to the die". In addition, some of the claims recite the steps of "wire bonding" the die to the leadframe, and "encapsulating" the die on the leadframe.

Further, all of the claims recite the step of providing a "cyanoacrylate" or "anaerobic acrylic" adhesive, and curing the adhesive "at a temperature between 20°C to 30°C in less than 60 seconds". Still further, some of the claims recite the step of "providing a filler configured to tailor a characteristic of the adhesive material in the package".

The primary reference, DiLeo et al., doesn't teach a semiconductor packaging method, even if a highly expanded definition of "packaging" is utilized. Rather, DiLeo et al. is directed to a "method of fabricating a microelectronic device". In addition, wire bonding and encapsulating steps for a semiconductor die are not performed in combination with a room temperature, instant curing step in DiLeo et al. DiLeo et al. also doesn't teach the present leadframe configuration with lead fingers, and teaches away from using any type of filler (column 2, lines 34-43).

The Examiner has characterized the above arguments as a "piecemeal" attack on DiLeo et al. However, if DiLeo et al. is the best reference on packaging using a room temperature

instant curing adhesive, it's hard not to point out it's deficiencies. In this regard, one skilled in the art reading DiLeo et al. would need to fill in many blanks to achieve the present method. Specifically, the primary relevant teaching of DiLeo et al. is at column 3, lines 35-36, which suggests that "epoxies that cure at room temperature" be used to bond the LEDs 10. However, most adhesive will cure at room temperature if given enough time, and there is no teaching in DiLeo et al. of an instant curing adhesive, or the advantages thereof. On the other hand, DiLeo et al. does specifically teach bonding of the microelectronic device (LED-10) using an unfilled epoxy cured at a temperature of 175°C to 185°C for a period of about 18 minutes (column 3, lines 49-50).

Mikuni et al. and O'Sullivan were cited as teaching cyanoacrylate adhesive compositions. Admittedly, room temperature instant curing adhesive have been around for years, and have been used to bond a variety of items. However, there has been no art cited on using a room temperature, instant curing adhesive to bond a "semiconductor die to a leadframe". Accordingly, this indicates a lack of motivation in the art for combining the secondary references with DiLeo et al.

Nishino et al. and Litke were cited as teaching the incorporation of a filler in a cyanoacrylate adhesive. Gruber et al. was cited as teaching the incorporation of a filler in an acrylate based anaerobic adhesive. However, there must be some motivation to modify the reference to establish obviousness. If DiLeo et al. specifically states that fillers shouldn't be used, one skilled in the art would be unlikely to modify the teaching of DiLeo et al. by incorporation of a filler.

In addition, the cited art does not disclose a semiconductor packaging method in which a filler improves the function of a room temperature, instant curing adhesive in the package. Accordingly, even if fillers have been used in

the past, they have not been used to perform the above stated function.

Conclusion

In view of the above arguments, favorable consideration and allowance of claims 1-22, and 40-44 is requested. Should any issues remain, the Examiner is asked to contact the undersigned by telephone.

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January 24, 2002
Date of Signature

Stephen A. Gratton
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MARKED VERSION OF AMENDED CLAIMS SHOWING CHANGES

1. (five times amended) A method for packaging a semiconductor die to form a semiconductor package comprising:

providing a leadframe[,] <u>;</u>

[configured for wire bonding to the die;]

providing a cyanoacrylate adhesive material formulated to cure in contact with the die in less than about 60 seconds in a temperature of about 20°C to 30°C and an ambient atmosphere;

providing a filler in the adhesive material selected to tailor a characteristic of the <u>adhesive material in the</u> package;

applying the adhesive material to the leadframe or to the die;

placing the die on the leadframe with the adhesive material in contact with the die and the leadframe to form an adhesive layer therebetween; and

curing the adhesive material in the temperature and the ambient atmosphere in less than about 60 seconds to bond the die to the leadframe.

4. (five times amended) The method of claim 1 wherein the leadframe comprises a lead-on-chip leadframe and the filler is selected to increase a dielectric strength of the adhesive [layer] <u>material</u>.

6. (six times amended) A method for packaging a semiconductor die to form a semiconductor package comprising:

providing a leadframe comprising a plurality of lead fingers[,] <u>;</u>

[configured to support the die and configured to provide sites for wire bonding to the die;]

providing a cyanoacrylate adhesive material formulated to cure in contact with the die in less than about 60 seconds

at a temperature of about 20°C to 30°C and in an ambient atmosphere;

providing a filler in the adhesive material selected to tailor a characteristic of the adhesive material in the package;

[improve a dielectric strength of the adhesive material in the package;]

applying the adhesive material to the [leadframe] lead fingers or to the die;

placing the die on the [leadframe] lead fingers with the adhesive material compressed between the die and the [leadframe] lead fingers to form an adhesive layer therebetween;

curing the adhesive material at the temperature and in the ambient atmosphere in less than about 60 seconds to bond the die to the [leadframe] lead fingers;

wire bonding the die to the lead fingers; and

encapsulating the die.

12. (six times amended) A method for packaging a semiconductor die to form a semiconductor package, comprising:

providing a leadframe comprising a plurality of lead fingers;

[configured for wire bonding to the die;]

applying an adhesive material on the lead fingers or on the die, the adhesive material comprising a cyanoacrylate adhesive formulated to cure in contact with the die in less than about 60 seconds at a temperature of about 20°C to 30°C and in an ambient atmosphere, and an electrically insulating filler configured to increase a dielectric strength of the adhesive material;

placing the die on the lead fingers with the adhesive material in contact with the die and the lead fingers to form an adhesive layer therebetween;

curing the adhesive material at the temperature and in the ambient atmosphere in less than about 60 seconds to bond the die to the lead fingers;

wire bonding the die to the lead fingers; and

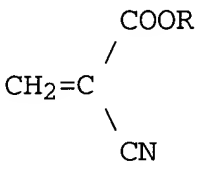
encapsulating the die.

15. (five times amended) A method for packaging a semiconductor die to form a semiconductor package, comprising:

providing a leadframe;

[configured for wire bonding to the die;]

providing an adhesive material having the formula:



wherein R is a hydrocarbon group, the adhesive material formulated to cure in less than about 60 seconds in contact with the die at a temperature of about 20°C to 30°C and in an ambient atmosphere;

providing a filler in the adhesive material selected to tailor a characteristic of the adhesive [layer] material in the package;

applying the adhesive material to the leadframe or to the die;

applying a catalyst to the leadframe or to the die;

placing the die on the leadframe with the adhesive material compressed between the die and the leadframe to form an adhesive layer therebetween;

curing the adhesive layer at the temperature and in the ambient atmosphere in less than about 60 seconds by interaction of the adhesive material with the catalyst to bond the die to the leadframe;

wire bonding the die to the lead frame; and

encapsulating the die.

21. (six times amended) A method for packaging a semiconductor die to form a semiconductor package comprising:

providing a leadframe;

[configured for wire bonding to the die;]

providing an adhesive material comprising an anaerobic acrylic formulated to cure in contact with the die in less than about 60 seconds at a temperature of about 20°C to 30°C and in an ambient atmosphere;

providing a filler in the adhesive material comprising a material selected from the group consisting of SiO_2, Al_2O_3, AlN, Ag, Ni, Fe, SiC, and polystyrene coated Ni;

applying the adhesive material to the leadframe or to the die;

placing the die on the leadframe with the adhesive material compressed between the die and the leadframe to form an adhesive layer therebetween;

curing the adhesive material at the temperature and in the ambient atmosphere in less than about 60 seconds to bond the die to the leadframe;

wire bonding the die to the lead frame; and

encapsulating the die.

42. (five times amended) A method for packaging a semiconductor die to form a semiconductor package, comprising:

providing a leadframe comprising a plurality of lead fingers configured to support the die and [configured to provide] comprising a plurality of bonding sites;

[for wire bonding to the die;]

providing an adhesive material comprising a cyanoacrylate adhesive or an anaerobic acrylic formulated to cure in contact with the die in less than about 60 seconds at a temperature of about 20°C to 30°C and in an ambient atmosphere;

providing a filler in the adhesive material selected to tailor a characteristic of the adhesive material in the package;

[improve the dielectric strength of the adhesive material in the package;]

applying the adhesive material to the die or to the leadframe;

placing the die on the leadframe with the adhesive material in contact with the die and the leadframe to form an adhesive layer therebetween;

curing the adhesive material at the temperature and in the ambient atmosphere in less than about 60 seconds to bond the die to the leadframe;

wire bonding the die to the [lead fingers] bonding sites; and

encapsulating the die.